

Bonner zoologische Beiträge	Band 56 (2007)	Heft 1/2	Seiten 43–48	Bonn, März 2008
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Biting Midges of the Genus *Palpomyia* Meigen (Diptera: Ceratopogonidae) in India

Sujit K. DAS GUPTA¹⁾, Abhijit MAZUMDAR²⁾ & Prasanta K. CHAUDHURI²⁾

¹⁾Department of Zoology, Presidency College, Calcutta, India

²⁾Department of Zoology, University of Burdwan, Burdwan, India

Abstract. The Indian species of *Palpomyia* Meigen are revised with the addition of two new species, *P. pseudorivularis* and *P. simplitheca* and two new records of *P. magna* Tokunaga and *P. stella* Tokunaga previously described from New Guinea. The species *P. flexidigita* Sinha et al. and *P. novita* Saha & Das Gupta are proposed as new synonyms of *P. crassipalpis* Sinha et al., and *P. barbara* Saha & Das Gupta is considered here as a new synonym of *P. deminutipalpis* Sinha et al.

Keywords. Diptera, Ceratopogonidae, *Palpomyia*, new species, synonyms, India.

1. INTRODUCTION

Palpomyia was established as a genus by MEIGEN (1818) (as a synonym of *Ceratopogon* Meigen) with the single type species, the European *Ceratopogon flavipes* Meigen. EDWARDS (1926) divided the genus into three groups on the basis of the number of spines and the degree of swelling of the fore femora. GROGAN & WIRTH (1975) recognized four distinct groups based on a combination of morphological features.

The larvae of *Palpomyia* are an important source of food for fishes preying on zoo benthos (REMM 1976) and are utilized as indicators of water quality on account of their response to certain types of pollution (GROGAN & WIRTH 1979). According to BORKENT & WIRTH (1997) and updated by BORKENT (2008), there are 264 extant species, including nine Indian species: *Palpomyia albiditarsis* Kieffer 1910, *P. himalayae* (Kieffer, 1911), *P. leucopogon* Kieffer 1911, *P. rivularis* Kieffer 1911, *P. crassipalpis* Sinha, Das Gupta & Chaudhuri 2003, *P. deminutipalpis* Sinha, Das Gupta & Chaudhuri 2003, *P. flexidigita* Sinha, *P. barbara* Saha & Das Gupta 2005, and *P. novita* Saha & Das Gupta 2005.

This paper presents a revision of the Indian species of *Palpomyia* including two new species and new records of two species previously known only from New Guinea. *Palpomyia flexidigita* and *P. novita* are proposed as new synonyms of *Palpomyia crassipalpis* and *P. barbara* as a new synonym of *Palpomyia deminutipalpis*. Thus, the total number of valid species of *Palpomyia* in India adds up to ten.

2. MATERIAL AND METHODS

The insects were collected with light traps at different localities in West Bengal, India. They were cleared and mounted in a mixture of phenol and Canada Balsam on microscope slides after appropriate orientation. Morphological terminology used in the species descriptions mostly follows GILES & WIRTH (1984) and BOSE et al. (2003). Types and identified specimens are housed in the Insect collections of the Entomological Laboratory of the University of Burdwan and will be submitted to the National Zoological Collections (NZC), Calcutta.

3. TAXONOMY

Key to Indian species of *Palpomyia* Meigen

* Kieffer types are considered lost, hence types of these species were not seen and the species names may be nomina dubia.

1. Wing membrane pale brown to grayish 2
Wing membrane hyaline 7
2. Scutum with short anteromedially bristles and without tubercle 3
Scutum without any bristles anteromedially and with tubercle 4
3. Male with narrow sternite IX having a deep caudo median excavation
Gonostylus short, bud-like, with a blunt end
..... *crassipalpis* ♂

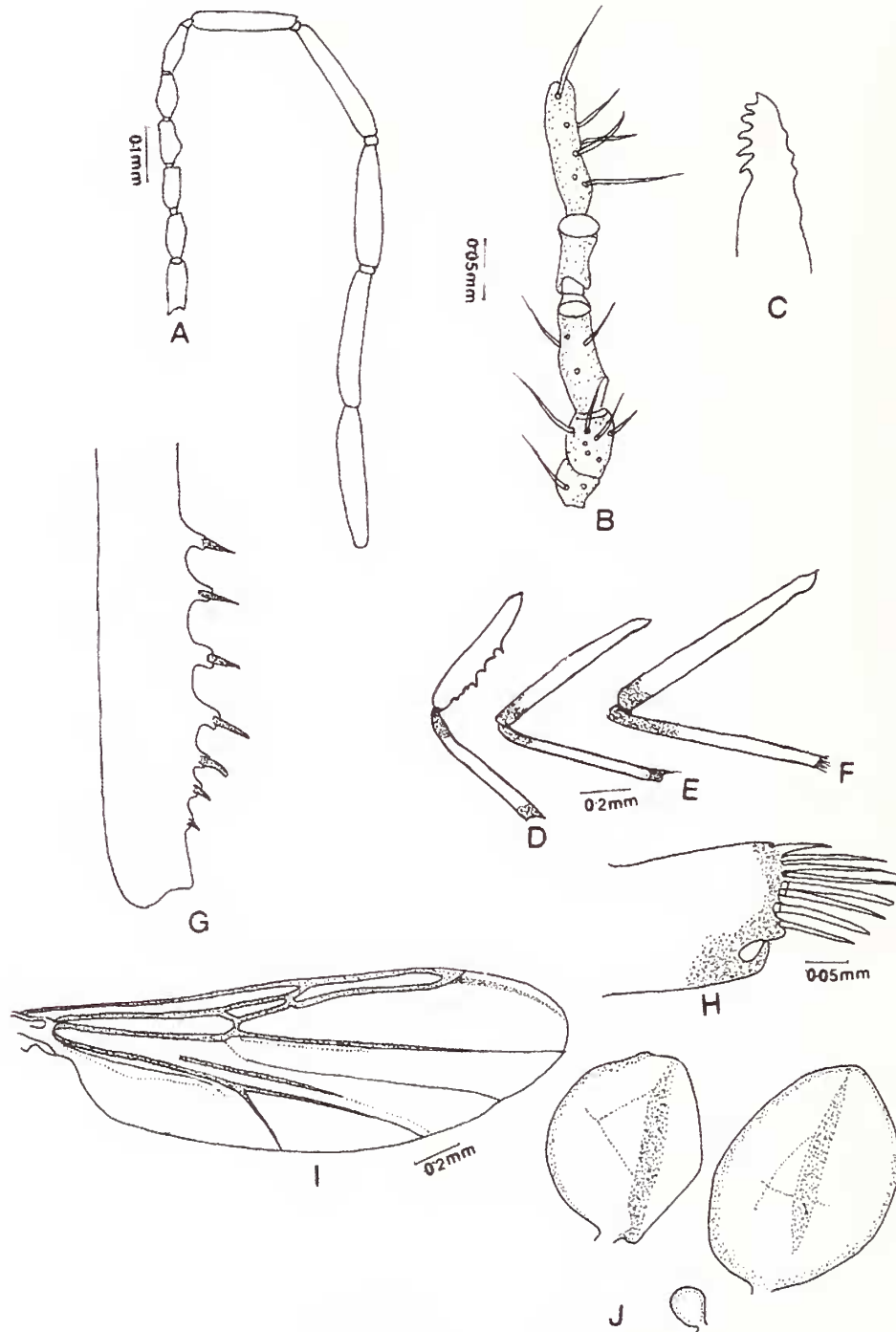


Fig. 1. A-J. *Palpomyia pseudorivularis* sp.n. ?. A) antenna, B) Palpus, C) Mandible, D-F) fore, mid, hind femora and tibiae, G) spines on fore femur, H) hind tibial comb, I) wing, J) spermathecae.

- Male with a broad sternite IX, without caudomedian excavation. Gonostylus slender, with a hooked tip
..... *deminutipalpis* ♂
4. Mid and hind femora with dark brown apical bands.
Mid tibia with one apical spine 5
Mid and hind femora pale, without pigmented bands.
Mid tibia without apical spine 6
5. Palpal segment III of female with a subapical pit with two sensillae. Palpal segment V with a long apical spines *implitheca* ♀
Palpal segment III of female without sensillae. Palpal segment V with a short subapical spine
..... *pseudorivularis* ♀
6. Female with inflated forefemur bearing 8–10 ventral spines on entire length *magna* ♀
Forefemur slender in both sexes, with 3 and 4 apical spines, respectively *stella* ♂, ♀
7. All femora of male armed with stout spines
..... **leucopogon* ♂
Only fore femora armed with stout spines 8
8. Female thorax shining red, bearing a pair of medio-lateral spinules **himalayae* ♀
Female thorax either dark brown or black and devoid of spinules 9
9. Female dark brown with pale halter .. **albiditarsis* ♀
Female with a deep black body and dark brown halter
..... **rivularis* ♀

Descriptions of the species

Palpomyia crassipalpis Sinha, Das Gupta & Chaudhuri, 2003 (SINHA et al. 2003: 75).

Palpomyia flexidigita Sinha, Das Gupta & Chaudhuri, 2003: 79. **New synonym.**

Palpomyia novita Saha & Das Gupta, 2005: 63. **New synonym.**

♀: Unknown.

Material: Holotype ♂, West Bengal, Panagarh Agriculture Farm, 20.vi.1990. leg. P. K. Chaudhuri. 2 ♂, Durgapur, 13.vii.2001, leg. D.Sai; 1 ♂, Asansol, 18.viii.2001, leg. S. Sen.

Remarks. SINHA et al. (2003) described the species from India. The midges in the present study conform fully with those of the above authors and the holotype of *P. crassipalpis*. After critical study and a comparison of *Palpomyia flexidigita* and *P. novita* with *P. crassipalpis* it has been concluded that these species are synonymous with *Palpomyia crassipalpis*. In this context, it should be noted that Fig.1 of *P. crassipalpis* was mistakenly printed as Fig. 3 of Sinha et al. (2003).

The species may be diagnosed by the following combination of character states: short palpal segments, anterior part of thorax hairy, 5 bristles on the scutellum, femora with dark brown broad apical band, hind tibia dark brown with pale band at its apical 1/3rd, 5 forefemoral spines, 9 spines of hind tibial comb, thumb like hind tibial spur, grayish wing about three times longer than broad, r_2 1.5 times longer than r_1 , aedeagus with longer recurved basal arms and slender distal arm, parameres fused and slender gonostylus ending with a bud

Palpomyia deminutipalpis Sinha, Das Gupta & Chaudhuri, 2003 (SINHA et al. 2003: 79).

Palpomyia barbara Saha & Das Gupta, 2005: 62. **New synonym.**

♀: Unknown.

Material. 3 ♂, West Bengal, Asansol, 23.vii.2001, leg. G. Bhattacharyay; 1 ♂, Kumardubi, 25.vii.2001, leg. D. Sai. Holotype ♂, Belpahari, 8.vi.1991, leg. S. Sinha.

Remarks. The present specimens conform with those of SINHA et al. (2003) in structures and the morphometrics. The diagnostic features of the species are: elongated palpal segment II with sensory pit, reduced palpal segment V, scattered hairs and streak on thorax, 7 fore femoral spines, hind tibial comb of 7 spines, r_2 little longer than r_1 , elongated gonocoxite with broad base, short gonostylus with bud at the tip, triangular aedeagus having deep median excavation and heavily sclerotized parameres with fused basal arms

On examination of the types and previous description of SINHA et al. (2003), it appears that *Palpomyia deminutipalpis* and *Palpomyia barbara* are the same species and *P. barbara* is proposed as a new synonym of the former species due to similarities of morphological features as stated above.

Palpomyia magna Tokunaga, 1966
(TOKUNAGA 1966: 130).

Material: 2 ♀, West Bengal, Jorebanglow (2040m), 21.vii.2001, leg. U. Majumdar; 1 ♀, Tindharia (1320 m) 25.vii.2001, leg. S.K. Pradhan.

Remarks. TOKUNAGA (1966) described the female of the species from New Guinea. In the course of the present study, three insects of the Himalayas are identified as conforming fully to the description by TOKUNAGA (1966). The species may be diagnosed by: eyes separated as wide as one facet, 12 (6 large and 5 minute) mandibular teeth, scutellum with 4 large and many small bristles, fore femur mostly with 10 spines, hind tibial comb of 8 spines,

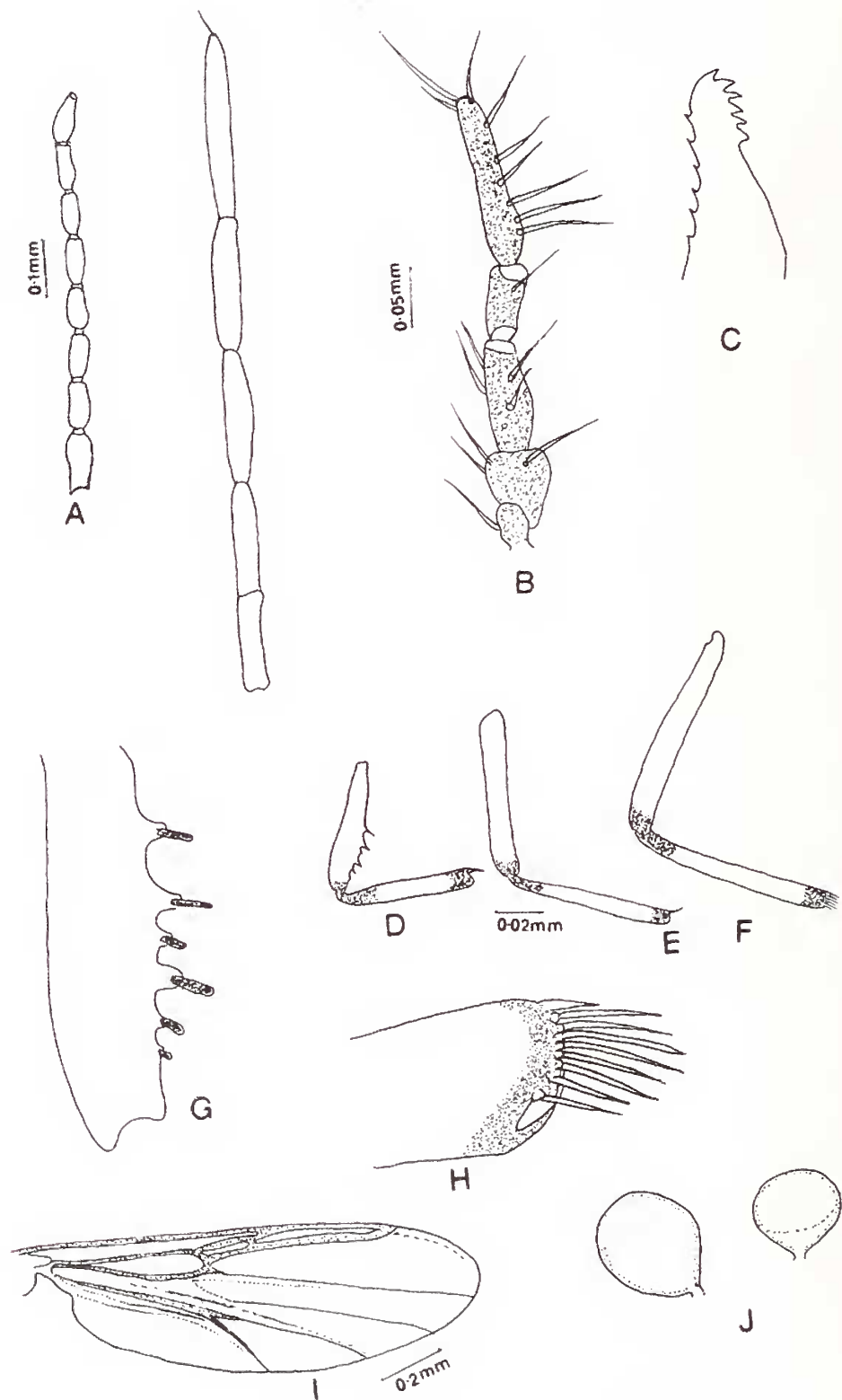


Fig. 2. A–J. *Palpomyia simplitheca* sp.n. ?. A) flagellomeres I–XIII, B) Palpus, C) mandible, D–F) fore, mid, hind femora and tibiae, G) spines on fore femur, H) hind tibial comb, I) wing, J) spermathecae.

wing pale with brown apical part, r-m shorter than σ of the base of Rs and M, abdomen ochreous with pale bands on segments I–IV, dark brown bands on segments V–IX, small gland rod and two sub equal oval spermathecae.

Palpomyia pseudorivularis Das Gupta, sp. n. (Figs 1A–J)

♀. Head. Eyes separated completely. Antenna (Fig. 1A) with flagellomeres I–VIII yellow at bases, IX–XIII completely brown with pale bases and 2x length of VII; lengths of flagellomeres I–XIII 8: 5: 5: 5: 5: 6: 10.5: 13.5: 14.5: 16: 18.5, AR (Antennal ratio) 1.65. Palpus (Fig. 1B) uniformly brown, palpal segment III with apical sensory pit, segment V elongated bearing a sub apical spine; length ratio of palpal segments I–V 3: 4: 7: 5: 10, PR (Palpal ratio) 3.0. Mandible (Fig. 1C) with 6 strong teeth.

Thorax. Brown, very hairy with small blunt anterior tubercle, scutellum pale, with 8 large and many small bristles.

Legs (Figs 1D–F). Coxae brown, trochanters yellow, fore femur (Fig. 1G) with 7 stout spines, mid and hind femora with dark brown apical band, tibiae with dark brown basal and apical bands, mid tibia with 1 apical spine, tarsomeres I–II light yellow, III light brown, IV–V totally brown, mid tarsomeres I–II with 2 apical spines; length ratio of leg segments 23:19: 8: 4: 2.5: 2: 3 in fore leg, 28: 23: 12: 4: 2: 1.5: 2.5 in mid leg, 32: 27.5: 14: 7: 2.5: 2: 3 in hind leg. TR (Tarsal ratio) of hind leg 2.0. Hind tibial comb (Fig. 1H) with 7 spines.

Wing (Fig. 1I): Wing length 2.85 (2.84–2.85, n=4), wing breadth 1.05 (n=3) mm. Membrane light brown with brown veins, R_{4+5} ending well beyond the middle, r_2 2.33 times longer than r_1 (21:9), costal length 2.31mm; CR (Costal ratio) 0.81. Halter brown.

Abdomen. Tergites brown, cerci brown, gland rods distinct. Spermathecae (Fig. 1J) large, unequal, 0.18 x 0.12 and 0.14 x 0.10 mm, and the third rudimentary distinct.

Material. Holotype ♀, Darjeeling (2180m) 20.x.1978, leg. Sikha Sarkar. Paratypes 2 ♀, Darjeeling, 12.ix.2002, leg. A. Mazumdar.

Remarks. Due to its relatedness to *P. rivularis* Kieffer, 1911, the species is named *P. pseudorivularis*. It resembles *P. rivularis* Kieffer in the shape of the flagellomeres, tarsomere I and structure of the spermathecae. The color pattern of the hind tibia and the femoral spines of *P. subsparsa* (Coquillett, 1901) and *P. tainana* Kieffer, 1912 are somewhat similar to those of the new species, but the following character states are distinctive: dark palpal segment III with an apical pit, 6 strong teeth of mandible, very

hairy thorax, 8 bristles on the scutellum, dark brown color band of hind tibia, 6 stout femoral spines, 7 spines of hind tibial comb, length of r_2 , dark brown halter knob distinct gland rod, structure of spermatheca and distinct rudimentary spermatheca.

Palpomyia simplitheca Das Gupta, sp. n. (Figs 2A–J)

♀. Head. Eyes separated as widely as 2 facets. Antenna (Fig. 2A) with flagellomeres I–VIII yellow basally, apically brown, IX–XIII brown with pale bases and almost equal or longer than VIII; length ratio of flagellomeres I–XIII 8: 5.5: 5: 5: 5: 5: 5: 5: 10: 12: 12.5: 13.5: 18, AR 1.52. Palpus (Fig. 2B) uniformly brown; palpal segment III with a sensory pit having 2 sensillae, segment V long with a long stiff spine in addition to normal two; length ratio of palpal segments I–V 2.5: 4: 6.5: 4.5: 10, PR 3.25. Mandible (Fig. 2C) with 6 large strong teeth.

Thorax. Dark brown with a few anterior hairs and a small blunt anterior tubercle, scutellum pale with 4 large and several small bristles.

Legs (Figs 2D–F). Coxae brown, trochanters yellow, fore femur (Fig. 2G) with 6 short and stout apical spines, mid and hind femora with dark brown apices, tibiae with dark brown basal and apical bands, color band of hind tibia narrow, tarsomeres I–II pale yellow, III little brown, IV–V brown; length ratio of leg segments 18.5: 16.5: 8: 3: 2: 1.5: 3 in fore leg, 23: 20: 11: 3: 2: 1.5: 2.5 in mid leg, 28: 24: 13: 5: 2: 1.5: 3 in hind leg. TR of hind leg 2.6. Hind tibial comb (Fig. 2H) with 8 spines.

Wing (Fig. 2I). Wing length 2.38 (2.35–2.39, n=4), wing breadth 0.84 (0.84–0.85, n=4) mm. Membrane light brown, R_{4+5} ending well beyond the middle, M_2 arising before r-m cross vein; r_2 2.35 times longer than r_1 , costal length 1.93 mm. CR 0.8. Halter brown with light brown knob.

Abdomen. Tergites brown, cerci brown. Spermathecae (Fig. 2J) simple, small, unequal, 0.091 by 0.067 mm and 0.076 by 0.062 mm.

Material. Holotype ♀, Darjeeling, 23 .VII.1968, leg. S.K. Das Gupta.

Paratypes 2 ♀, Darjeeling, 23, vii. 1968, leg. S. K. Das Gupta; 1♀, 28.vii.2001, leg. U. Majumdar.

Remarks. The species is named *P. simplitheca* due to the simple spermatheca. In the number and nature of mandibular teeth, the wing, and the spermathecae, the species resembles the females of *P. flaviceps* (Johannsen, 1908) and *P. jimmensis* Tokunaga, 1966. The color pat-

tern of legs of the new species and of *P. lineata* (Meigen) appears more or less similar. It appears to be closer to *P. pseudorivularis* but the following combination of character states is unique: flagellomeres IX–XI brown at base, yellow at the apices and almost equal in length to flagellomere VIII, 6 large teeth of the mandible, thorax with a few anterior hairs and a small blunt anterior tubercle, 8 large bristles and several small bristles on scutellum, color pattern of femora and tibiae, narrow color band on hind tibia, 8 spines on hind tibial comb, length of r_2 , and a simple, small spermatheca

***Palpomyia stella* Tokunaga, 1966**

(TOKUNAGA 1966: 136).

Material. 3 ♂ 2 ♀, Burdwan, 17.vi.1999, leg. P.K. Chaudhuri; 2 ♂, 2 ♀, Durgapur, 12.v.2000, leg. D. Sai; 1 ♂, Uttarapara, 01.viii.2001, leg. U. Majumdar; 1 ♂, Chinsura, 21.vii.2003, leg. D. Sai

Remarks. TOKUNAGA (1966) originally described this species from New Guinea and New Britain. A few biting midges in our study are identified as *Palpomyia stella* because they appear indistinguishable. The species may be identified by the following combination of characters: small size, very pale ochreous palpus, swollen segment III, presence of conical scutal tubercle, scutellum with 4 long bristles and 15 short bristles, absence of definite color pattern on legs, 3 spines on fore femur, 3 spines on the hind tibial comb, pale wing with C extending beyond the end of R_{4+5} , r_2 2.25 times longer than r_1 , slender and tapered gonocoxite, gonostylus swollen arched, with 3–4 small setae, trapezoid aedeagus, fused parameres with star-like median lobe little longer than basal arms and the tip rounded, bearing barb-like hook; female abdominal tergites I–II with pale median linear stripes, absence of gland rods and presence of two unequal oval spermathecae.

Acknowledgements. We are thankful to the Ministry of Environment & Forests, Govt. of India for funding the project of the Dipteran fauna of India and to the Heads of the Department of Zoology, University of Burdwan and Presidency College, Calcutta for laboratory facilities. Our sincerest gratitude owes to Dr. Art Borkent of the Royal British Columbia Museum, Canada for critical appraisal of the manuscript and for his useful suggestions for its improvement.

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Authors’ addresses: Professors Sujit K. DAS GUPTA, Department of Zoology, Presidency College, Calcutta 700 073, India; Abhijit MAZUMDAR & Prasanta K. CHAUDHURI, Department of Zoology, University of Burdwan, Burdwan 713 104, India; E-Mail: chaudhuri_pk@yahoo.co.in; abhijitau@rediffmail.com.

Received: 5.12.2007

Revised: 21.03.2008

Accepted: 11.04.2008

Corresponding editor: N. Dorchin